IMAGE SCANNING SYSTEM AND METHOD FOR SCANNER

FIELD OF THE INVENTION

This invention relates to an image scanning system and method for scanner and particularly a system and method that is capable of completing image scanning rapidly without a pre-scanning process.

BACKGROUND OF THE INVENTION

Optical scanner is a computer peripheral device that employs photoelectric conversion principle to convert scanning object image to digital data. The scanning method mainly includes projecting a linear light source on the scanning object, using an image capturing element to capture the image reflecting from the scanning object, then employing photoelectric conversion principle to convert the object image to digital signals for output.

Referring to FIG. 1A, a conventional optical scanner consists of a document holding board 10 for holding a scanning object 11 thereon which is generally a flat document, and an optical chassis 12 constructed in a modular manner which consists of a linear lamp tube 121, a plurality of reflection mirrors 122, a lens 123 and an image capturing element 124. During scanning operation, the linear lamp tube 121 projects light on the scanning object 11, and the reflection mirrors 122 receive the image reflecting from the scanning object 11. The reflection mirrors 122 are properly positioned such that they can receive the image reflecting from the scanning object 11 and transmit the image of the object 11 to the lens 123 which refracts and forms an image on the image capturing element 124. The image capturing element 124 employs photoelectric conversion principle to convert the image of the object 11 to digital signals. At this time, the scanned image data in the scanner is only a piece of the total object image. Hence a driving means (not shown in the drawing) shall be used to drive the optical chassis 12 to move along the holding board 10 for scanning the object image completely.

However, the scanner usually has to proceed a calibration process before performing the scanning operation. It mainly uses the image capturing element 124 to scan a calibration chart (not shown in the drawing) located inside the upper lid of the scanner. The calibration chart generally has a selected calibration pattern formed in black and white color at a staggered manner according to a specific calibration requirement. The

image data obtained after scanning of the calibration chart will be processed to get a calibration parameter. The image capturing element then uses the calibration parameter to perform calibration for setting the left and right hand side margins, scanning starting position value and light intensity compensation and calibration value for the linear lamp tube. As the scanner which has processed the calibration can result in better scanning quality than the one which does not have calibration process, almost all scanners now being used perform calibration process and get the calculation parameter before proceeding formal scanning of the object, and through using the calibration parameter to perform the compensation and calibration for the scanning image to produce a better scanning image quality.

Referring to FIG. 1B, the image scanning process of a scanner adapted a conventional technique includes the steps of: providing a scanning object 131, performing a pre-scanning process and calculating the calibration parameter 132, using the image capturing element of the optical chassis to capture the image of the scanning object 133, performing image calibration and compensation according to the calibration parameter 134, and finishing object scanning 135 and repeating the step 131.

Although the calibration process may enable the scanner to get a better scanning quality for every scanning operation, the calibration process takes a lot of time. In fact, each calibration consumes about 7-8 seconds. Total time for scanning the object generally is slightly over ten seconds. Hence the calibration process takes a relatively large portion of the total scanning time. When the scanner is used for scanning a great amount of document, time being spent and wasted on calibration becomes significant.

Therefore it is desirable to design a scanner that does not need calibration for every scanning operation and which can directly scan the object without affecting scanning quality thereby to save a lot of calibration time and improve utilization efficiency of the scanner.

SUMMARY OF THE INVENTION

The primary object of this invention is to provide an image scanning system and method that offers calibration parameter without performing calibration process so that the scanner may directly perform object scanning for increasing scanning efficiency of the scanner.

Another object of this invention is to provide an image scanning system and method that performs a pre-scanning calibration before scanning, and uses the obtained calibration parameter as the calibration basis for subsequent scanning thereby enables the scanner to directly perform scanning for increasing efficiency.

The image scanning system of the scanner according to this invention consists of a transparent holding board, an optical chassis and a control module. The scanning object is located above the holding board and the optical chassis is located below the holding board. There is an image capturing element located inside the optical chassis for performing image scanning on the scanning object. In the control module or a selected systems file, there is a memory for storing the calibration parameters of the scanner.

When the memory is Read Only Memory (ROM), it can store the calibration parameters which are obtained through calibration parameter empirical value based on the scanner design specifications. Every time the scanner performs scanning operation, the image capturing element of the optical chassis reads the object image located above the holding board and uses the control module or selected system file to fetch the calibration parameter from the memory, then based on the calibration parameter to do compensation and calibration for getting a better quality of scanning image without performing calibration every time.

When the memory is a Random Access Memory (RAM), it can store the calibration parameters obtained from the pre-scanning when the scanner is initially powered on. Every time the scanner performs scanning operation, the image capturing element of the optical chassis reads the object image located above the holding board and uses the control module or selected system file to fetch the calibration parameter from the memory, then based on the calibration parameter to do compensation and calibration for getting a better quality of scanning image. The calibration may be done one time at the initial power on without performing calibration every time.

As the calibration parameters are stored in the memory of the control module, the scanner of this invention can directly perform scanning for the object without the need of doing calibration or calculating the calibration parameter every time. Scanning time thus will be greatly reduced and better scanning quality will be achieved, and may result in an increased scanning efficiency for the scanner.

The invention, as well as its many advantages, may be further understood by the following detailed description and drawings. The drawings are only to serve for

reference and illustrative purpose, and do not intend to limit the scope of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A is a schematic view of a scanner performing scanning operation adapted a conventional technique.

FIG. 1B is a process flow of a scanner performing scanning operation adapted a conventional technique.

FIG. 2A is a schematic view of an image scanning system of a scanner according to this invention.

FIG. 2B is a process flow of an image scanning method according to a first embodiment of this invention.

FIG. 3 is a process flow of an image scanning method according to a second embodiment of this invention.

FIG. 4 is a process flow of an image scanning method according to a third embodiment of this invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

This invention aims at providing an image scanning system and method characterized by storing calibration parameters of the scanner in the memory of a control module or a selected system file, and directly reading the calibration parameters stored in the memory from the control module during scanning, and based on the calibration parameters to perform compensation and calibration for the scanning image or directly execute the selected systems file. As this invention does not need to perform calibration for getting calibration parameters for every scanning, scanning of the object image can be done more rapidly. Moreover, through the calibration parameters to perform compensation and calibration for the scanning image, the scanning image of a better quality can be obtained. More details of this invention will be elaborated by referring to the following embodiments.

Referring to FIG. 2A, the image scanning system of the scanner according to this

invention includes a transparent holding board 20, an optical chassis 21 and a control module 22. The transparent holding board 20 is preferably made of glass or acrylic. The scanning object 23 is located above the holding board and the optical chassis 21 is located below the holding board 20 for reading the image data of the scanning object 23. The optical chassis 21 is a modular assembly consisting of a linear lamp tube 211, a plurality of reflection mirrors 212, a lens 213 and an image capturing element 214 (CCD). The linear lamp tube 211 projects light on the scanning object 23 located above the holding board 20, the reflecting mirrors 212 receive the reflecting image from the scanning object 23 and through refraction of the lens 213 to form an image of the object 23 on the image capturing element 214. The image capturing element 214 captures the image of the scanning object 23. As the image captured by the image capturing element 214 is only a portion of the total image of the object 23, a driving means (not shown in the drawing) shall be used to drive the optical chassis 21 to move along the holding board 20 for scanning the entire object 23 completely.

The scanner of this invention further includes a control module 22 which has a built in memory 221 for storing the calibration parameters of the scanner. The control module 22 based on the calibration parameters stored in the memory 221 performs calibration and compensation process for the image captured by the image capturing element 214 to achieve a desired scanning image quality. The setting method of the calibration parameters in the scanner will be described in the following.

For same type of scanners, their internal elements are made by standardized specifications, hence the calibration parameters for setting the left and right margins, and starting scanning value and intensity of the lamp tube generally do not have much difference. For the scanners that do not have high demand of scanning quality, the calibration parameters may be directly stored in the Read Only Memory (ROM) or systems file at the plant site before shipment. Therefore the scanner of this system does not have to perform calibration process for deriving the calibration parameters before every scanning operation, and may directly perform image scanning on the scanning object through the control module or system file to fetch the calibration parameters. As a result, scanning for the object image may be done and completed more rapidly. Furthermore, through the calibration parameters provided by the memory of the control module, the scanning image may have desired calibration and compensation thereby to obtain a better image scanning quality.

Referring to FIG. 2B for the process flow of a first embodiment of the image scanning system of this invention. The process includes the steps of: providing a scanning object

31, using the image capturing element of the optical chassis to capture the image of the scanning object 32, using the calibration parameters stored in the memory of the control module or system file to control the image capturing element to perform calibration and compensation for the captured image 33, completing the scanning for the object 35 and repeating the step 31.

In the process flow of a second preferable embodiment, the control module uses the Random Access Memory (RAM) for storing the calibration parameters. As the data stored in the RAM will be cleared and lost after the scanner is power off, in this embodiment every time the scanner is power on, an automatic calibration will be performed, and the most updated calibration parameters obtained in the calibration process will be stored in the RAM. Then in every subsequent scanning operation, the control module or system file will perform calibration and compensation process based on the calibration parameters stored in the memory. Thereby the scanner can get a better image scanning quality. Moreover, in this embodiment there is no need to perform calibration process for every scanning, a great deal of time that might otherwise spent for calibration process in the scanning operation will be saved.

Referring to FIG. 3 for the process flow of the second embodiment. The process includes the steps of: performing a pre-scanning process and calculating the calibration parameters 41, providing a scanning object 42, using the image capturing element of the optical chassis to capture the image of the scanning object 43, using the calibration parameters stored in the memory of the control module or system file to control the image capturing element to perform calibration and compensation for the captured image 44, completing the scanning for the object 45 and repeating the step 42.

Before proceeding scanning, the scanner of this invention may also determine if the control module or system file has the required calibration parameters. If the outcome is positive, the scanning operation will be directly executed. Otherwise a pre-scanning operation will be performed and calculation of the calibration parameters for the scanner will be done. Details will be described in the third embodiment shown in FIG. 4.

The process includes the steps of: determining if the control module or system file has the calibration parameters required 51; if negative, perform pre-scanning and calculate the calibration parameters 52 and store the obtained calibration parameters in the control module or system file 53; if positive, provide a scanning object 54; using the image capturing element of the optical chassis to capture the image of the scanning object 55, using the calibration parameters stored in the memory of the control module or system file to control the image capturing element to perform calibration and compensation for

the captured image 56; completing the scanning for the object 57 and repeating the step 54.

While the preferred embodiments of the invention have been set forth for purpose of disclosure, modifications of the disclosed embodiment of the invention as well as other embodiments thereof may occur to those skilled in the art. Accordingly, the appended claims are intended to cover all embodiments which do not depart from the spirit and scope of the invention.